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[54] **DISTRIBUTED COMPUTER NETWORK FOR TRACKING THE ACCESS PATH OF A USER**

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[52] U.S. Cl. 395/325; 364/DIG. 1;
364/242.94; 364/284.4; 364/285.4; 364/286.5
[58] Field of Search 364/DIG. 1; 395/200,
395/325, 600

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[57] **ABSTRACT**

Information with respect to a requested user who accessed a node and information with respect to a process activated in the node are stored in a file system. By successively tracking nodes accessed by the user, a path through which the user accessed the network is tracked. When the path of the network entered different management domains, a tracking operation is requested to nodes in the management domains. The results are collected and transferred to the requesting node.
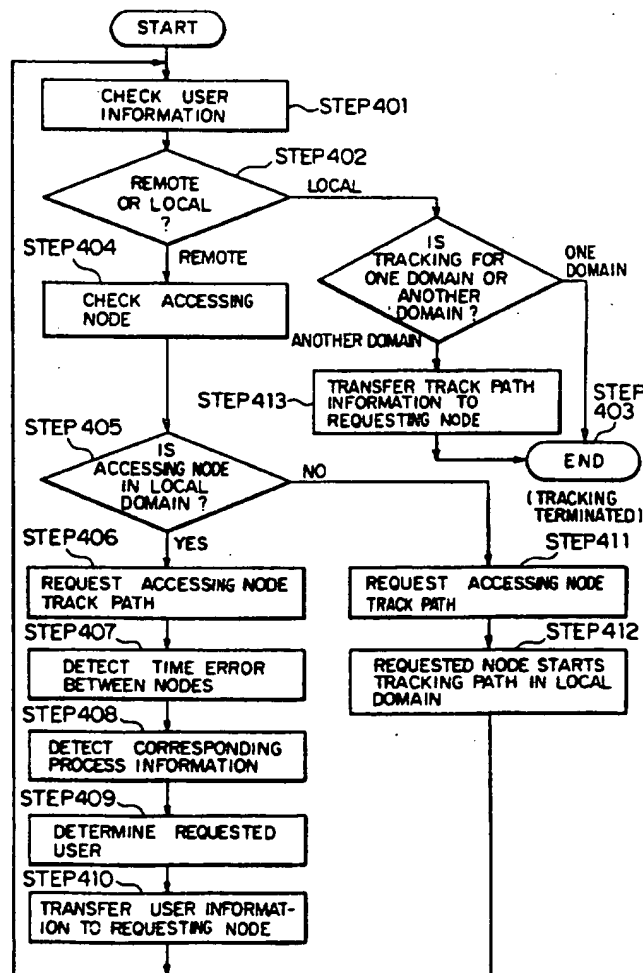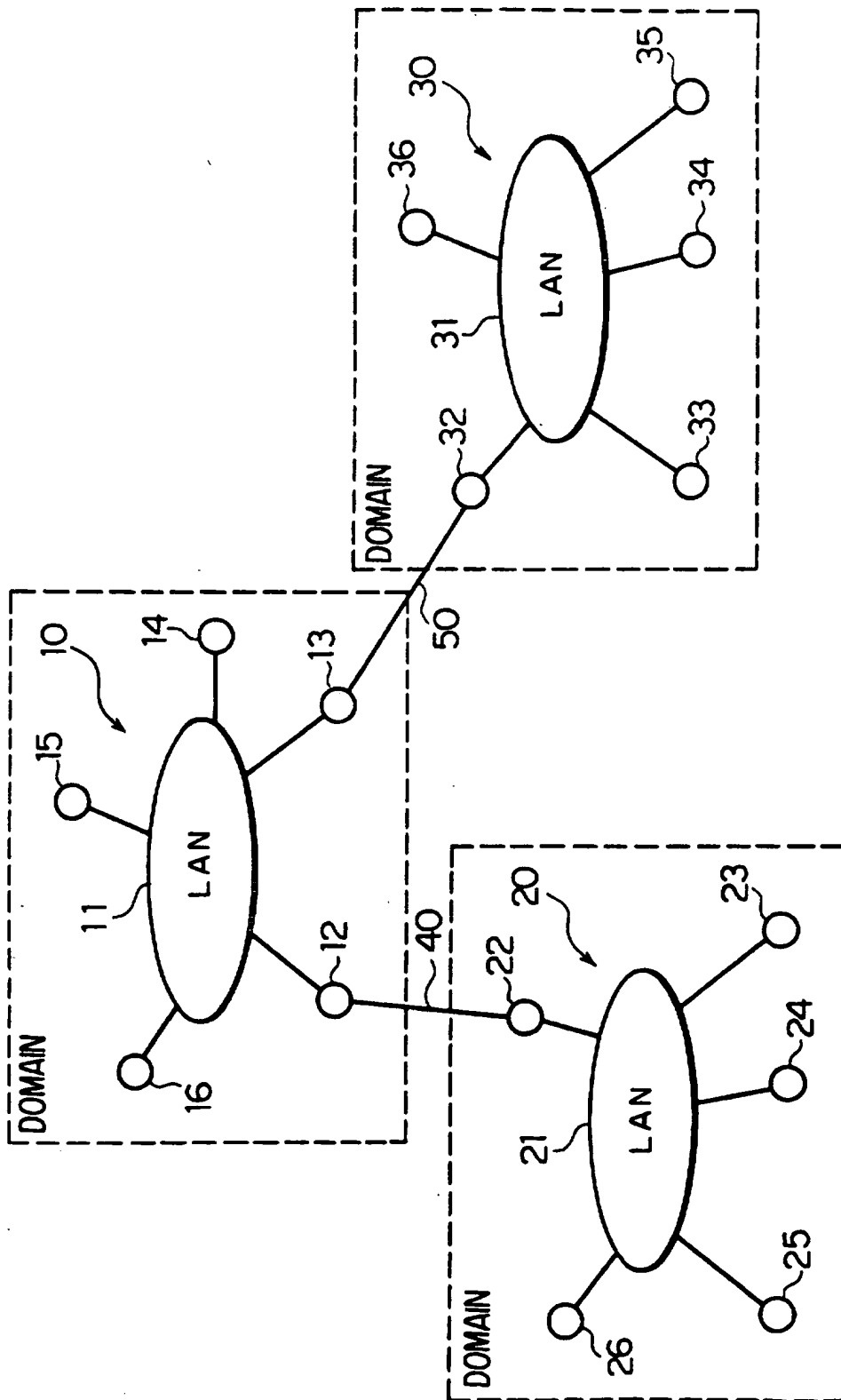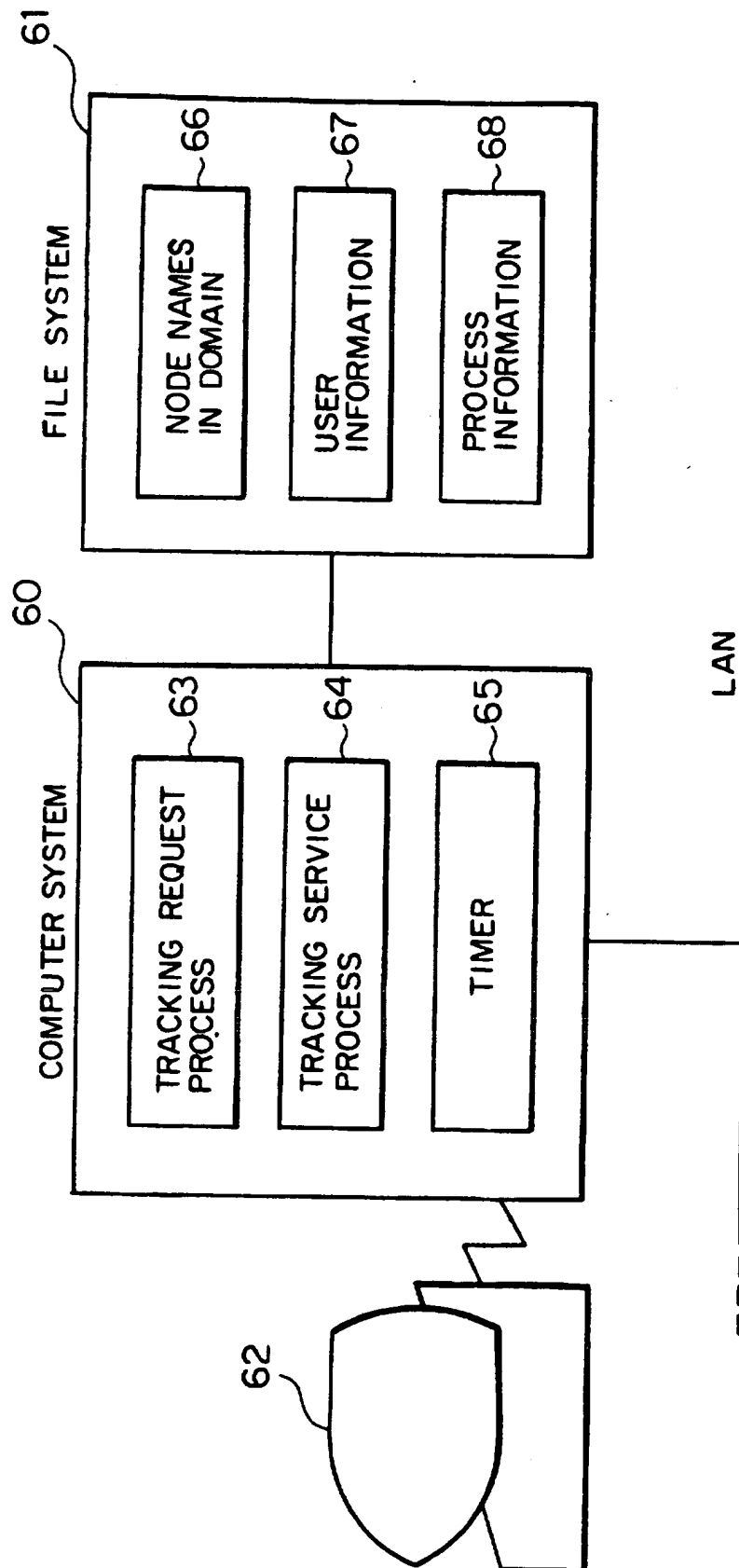
4 Claims, 4 Drawing Sheets
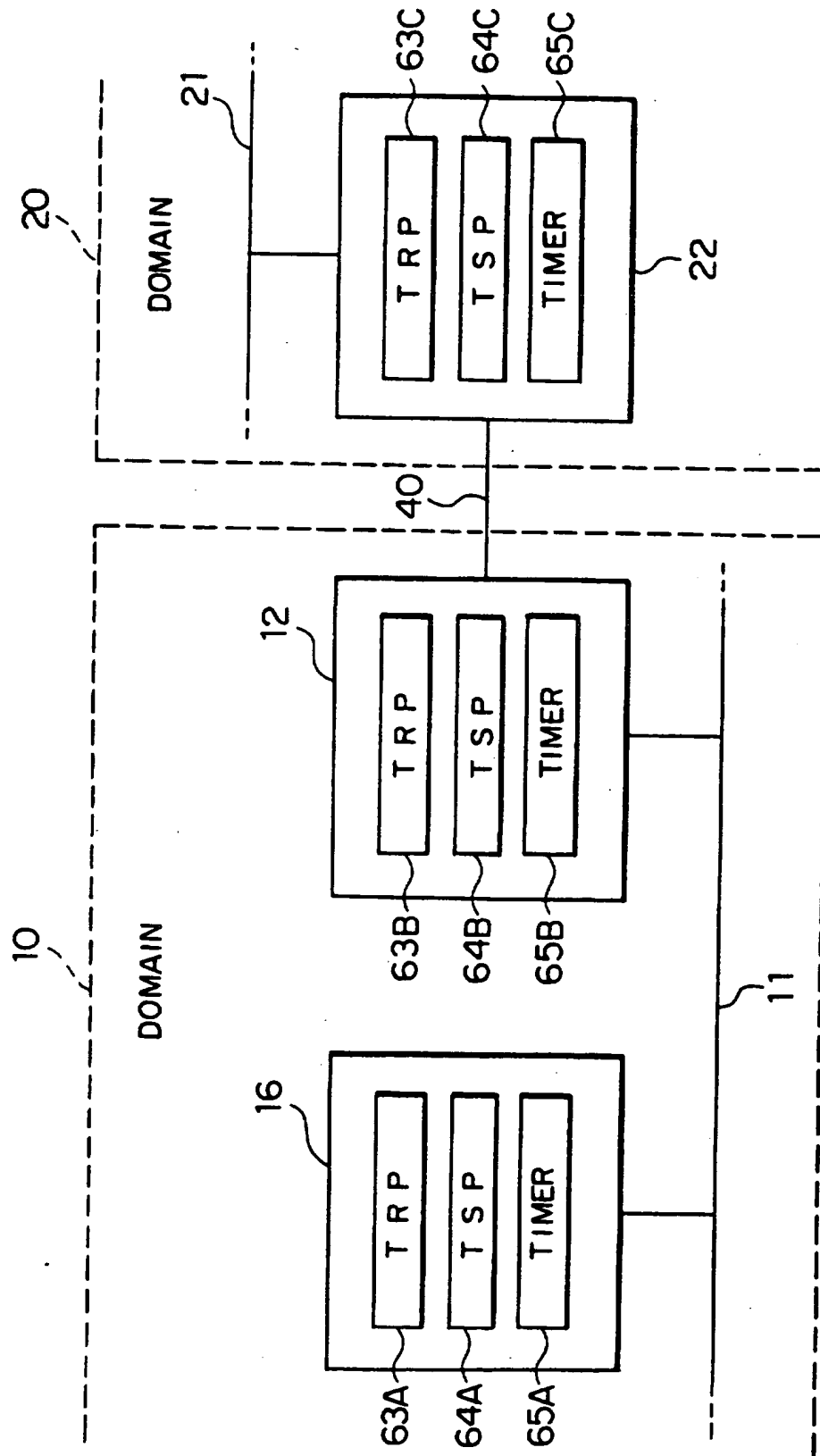
FIG. 1

FIG. 2

FIG. 3

FIG. 4

START

CHECK USER INFORMATION ～STEP401

STEP402

REMOTE OR LOCAL ?

LOCAL

IS TRACKING FOR ONE DOMAIN OR ANOTHER DOMAIN ?

ONE DOMAIN

REMOTE

STEP404

CHECK ACCESSING NODE

ANOTHER DOMAIN

STEP413～ TRANSFER TRACK PATH INFORMATION TO REQUESTING NODE

STEP 403

STEP405

IS ACCESSING NODE IN LOCAL DOMAIN ?

NO

END

(TRACKING TERMINATED)

STEP406   YES

STEP411

REQUEST ACCESSING NODE TRACK PATH

REQUEST ACCESSING NODE TRACK PATH

STEP407

DETECT TIME ERROR BETWEEN NODES

STEP412

REQUESTED NODE STARTS TRACKING PATH IN LOCAL DOMAIN

STEP408

DETECT CORRESPONDING PROCESS INFORMATION

STEP409

DETERMINE REQUESTED USER
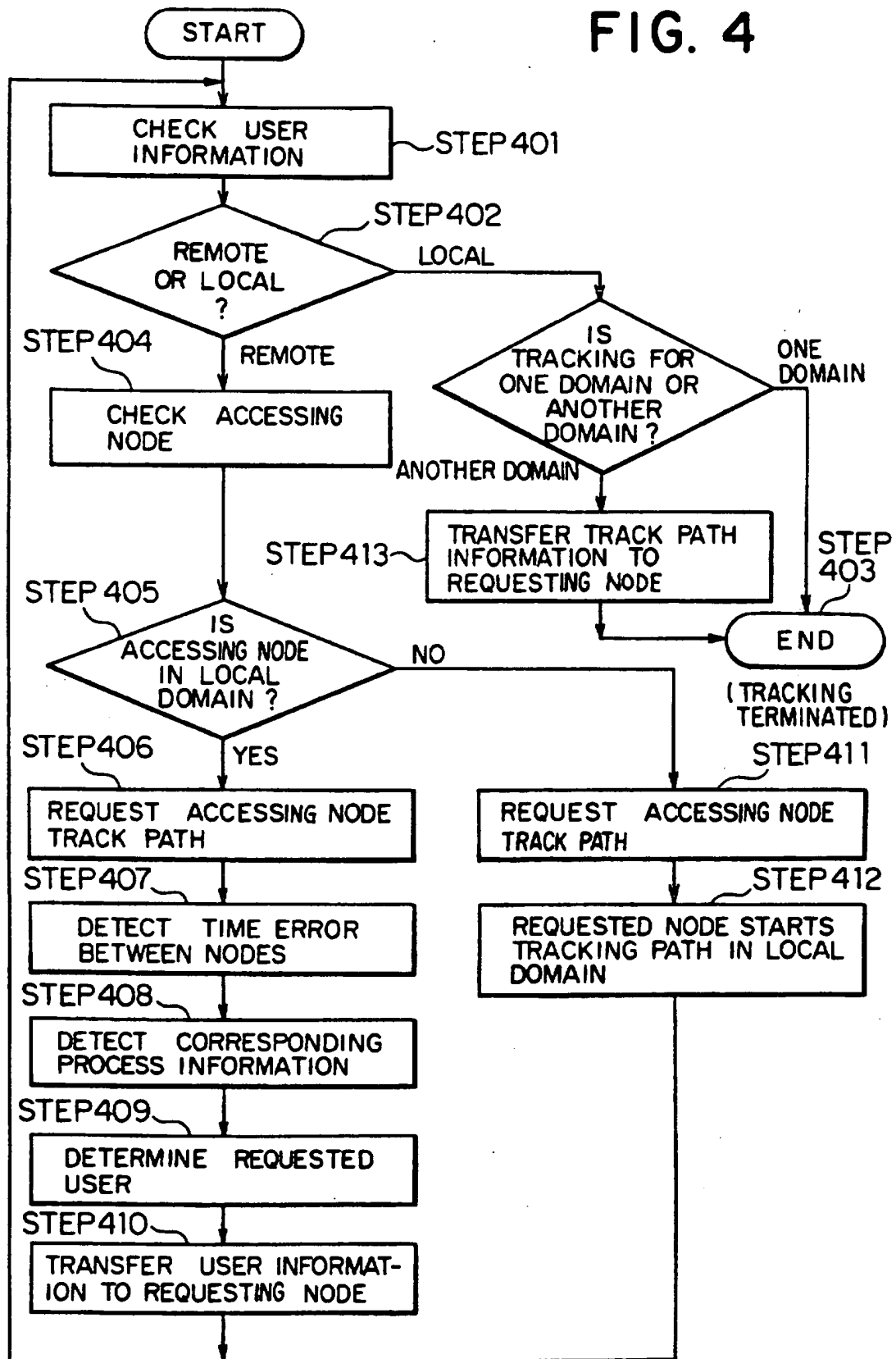
STEP410

TRANSFER USER INFORMATION TO REQUESTING NODE

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DISTRIBUTED COMPUTER NETWORK FOR TRACKING THE ACCESS PATH OF A USER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a distributed type computer network for connecting and unifying a plurality of computer systems distributedly disposed through a communication medium.

2. Description of the Related Art

Recently, a distributed type computer network for allowing resources such as a file system and CPU to be shared with a plurality of computer systems (hereinafter named nodes) has gained public attention.

The distributed type computer network can advantageously share its resources with the nodes distributed in wide areas. However, as the network scale increases, the probability of illegal accesses also proportionally increases.

To prevent that, it is necessary to track a node and a path through which an illegal user accessed the net-. work so as to improve the reliability thereof.

However, in most distributed type computer networks, at most the node just preceding the path through which the illegal user accessed the network can be tracked. Thus, to completely track the path through which the illegal user accessed the network, many complicated processes are required among all the related nodes and thereby much labor and time are disadvantageously used.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a distributed type computer network for readily and accurately tracking a requested user from any node without considering the entire structure of the network.

Another object of the present invention is to provide a distributed type computer network for tracking a path through which a requested user accessed the network even if the path entered a plurality of management domains.

To accomplish the above mentioned objects, the distributed type computer network for tracking a path through which a requested user accessed a network, the distributed type computer network having a plurality of nodes according to the present invention comprises user information storage means for storing at least a user name, distinctive information of a local access or a remote access, and an accessed node name for a remote access as information with respect to a user accessing the node, process information storage means for storing at least an activated process name and a process activated time as information with respect to a process activated in the node, determination means for determining whether an access of the node by any requested user is a local access or a remote access in accordance with the distinctive information contained in the user information, check means for checking an accessed node name in accordance with the user name of the requested user by using the user information when the determination means determined that the node is remotely accessed, tracking request means for transferring to the accessed node checked by the check means at least a local node name, connection process activated time and an activated process name in accordance with the user name of the requested user stored in the user information storage means and the process information

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storage means and for requesting the accessed node to track a path through which the requested user accessed the network, information search means for searching process information in accordance with information being transferred from the tracking request means from the process information storage means, and information transfer means for transferring user information in accordance with process information searched by the information search means to the tracking requesting node, whereby the tracking requesting node successively requests the accessed node to track the requested user through the tracking request means until the determination means determined that the access of the local node or the accessed node by the requested user is a local access.

Thus, according to the present invention, without considering the entire structure of the network, a path through which a requested user accessed the network can be readily and precisely tracked.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a block diagram showing the entire structure of a distributed type computer network of an embodiment according to the present invention;

FIG. 2 is a block diagram showing the structure of nodes in the distributed type computer network shown in FIG. 1;

FIG. 3 is a block diagram describing an operation of tracking a path through which a requested user accessed the distributed type computer network shown in FIG. 1; and

FIG. 4 is a flow chart showing an entire operation of tracking a path through which a requested user accessed the network.

DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to the accompanying drawings, embodiments according to the present invention will be described in the following.

FIG. 1 is a block diagram showing the entire structure of a distributed type computer network of an embodiment according to the present invention.

As shown in the figure, the distributed type computer network is composed of a plurality of LAN's (local area networks) 10, 20, and 30. The LAN's 10, 20, and 30 are composed of communication mediums 11, 21, and 31 and a plurality of nodes 12 to 16, 22 to 26, and 32 to 36, respectively, the communication mediums 11, 21, and 31 being connected to the plurality of nodes 12 to 16, 22 to 26, and 32 to 36, respectively. Particular nodes (12 and 22; and 13 and 32) in the LAN's 10, 20, and 30 are connected through dedicated communication mediums 40 and 50, respectively. Thus, data communications are made among all the nodes in the LAN's 10, 20, and 30.

In the distributed type computer network, portions of the LAN's 10, 20, and 30 which are surrounded with the dashed lines are named management domains. In other words, data communications are made directly among nodes only in each of the management domains.

FIG. 2 is a block diagram showing the structure of a node. In the figure, the reference numeral 60 is a computer system. The computer system 60 is connected to a file system 61 and a display input terminal 62. The computer system 60 is provided with a tracking request process 63 for requesting another node to track a path through which a requested user accessed the network; a

tracking service process **64** for receiving a tracking request from another node and for executing the tracking; and a timer **65** for retrieving current time.

In addition, the file system **61** stores all node names **66** included in the management domain of the local node, user information **67**, and process information **68**.

The user information **67** consists of the following data:

(1) the name of the user who accessed a particular node;

(2) the name of the accessing terminal;

(3) whether there was a remote access or a local access; and

(4) the name of the accessing node (in the case of a remote access).

The process information **68** consists of the following data:

(1) the name of the process activated;

(2) the activated time; and

(3) the name of the terminal activated.

Then, with reference to FIGS. 3 and 4, an operation of the distributed type computer network will be described.

In the node **16** of the LAN **10** (management domain) shown in FIG. 3, when a requesting user designates a user name to be tracked, a tracking request process (hereinafter named the TRP and illustrated in the flow chart of FIG. 4) **63A** in the node **16** is activated.

Thereafter, the TRP **63A** retrieves the user information **67** in the file system **61** by using the user name as key data (in the step **401**). The TRP **63A** determines whether or not the requested user is a local user or a remote user by using the resultant data (in the step **402**).

When the TRP **63A** determined that the requested user is a local user, it informs the requesting user of that through the display input terminal **62** and terminates the tracking operation (in the step **403**).

On the other hand, when the TRP **63A** determined that the requested user is a remote user, it checks the node from which the requested user accessed the network in accordance with the user information **67** being checked (in the step **404**).

Thereafter, the TRP **63A** determines whether or not the accessing node **12** is in the local management domain in accordance with the node names **66** in the local domain stored in the file system **61** (in the step **405**).

When the TRP **63A** determined that the accessing node **12** is in the local management domain, it transfers the following information items to a tracking service process **64B** (hereinafter named the TSP and illustrated in the flow chart of FIG. 4) in the accessing node **12** and requests it to track a path through which the requested user accessed the network (in the step **406**):

(a) the name of the local node;

(b) the current time;

(c) the time the process activated;

(d) the name of the process activated (the name of the activated connection process used for a remote access); and

(e) a serial number (which represents a serial access number when the same connection process is used in a local nodes).

Thus, the node **16** waits for the accessing node **12** to transfer the resultant data to it.

When the TSP **64B** in the node **12** received the tracking request, it retrieves the current time of the local node **12** by using the timer **65B**, compares it with the current time (b) transferred from the requesting node **16**, and obtains the error therebetween (in the step **407**).

Thereafter, the TSP **64B** searches the process information which meets both the connection process according to the "name of the process activated, (d)" and the "process" which designates the requesting node **16** from the file system **61** in the local node **12**.

Moreover, the TSP **64B** detects the process information **68** where the value whose process activated time was corrected by the time error between the nodes accords with the process activation start time (c) transferred from the requesting node **16** (in the step **408**).

When the TSP **64B** searched the process information **68**, it searches the requested user information **67** from the activated terminal name included in the process information **68** and determines that the user name of the user information **67** is the requested user (in the step **409**).

When the TSP **64B** did not obtain the process information which meets the time in the step **408**, it serially numbers the groups of the process information **68** in chronological order and searches the process information **68** whose number matches the serial number (e) transferred from the requesting node **16**.

Thereafter, the TSP **64B** searches the user information **67** in accordance with the process information **68** from the file system **61** in the local node by using the activated terminal name and then transfers the user information **67** to the TRP **63A** in the requesting node **16** (in the step **410**).

Practically, the following information is transferred to the TRP **63A** in the requesting node **16**:

(1) the name of the user;

(2 the connection process activated time (value where error has been corrected);

(3) the name of the accessing terminal;

(4) whether there was a remote access or a local access; and

(5) the name of the accessing node and the name of the used connection process (in the case of remote access).

Thereafter, the TRP **63A** in the requesting node **16** displays such information on the display input terminal **62**. In addition, the TRP **63A** redetermines whether the requested user is a local user or a remote user in the node **12** in accordance with the above mentioned user information in the step **402**. Thereafter, when the TRP **63A** determined that the requested user is a local user, it terminates the tracking operation (in the step **403**).

When the TRP **63A** determined that the requested user is a remote user, it redetermines whether or not the accessing node represented with the information (5) is included in the local management domain in the step **405**.

As the result, when the TRP **63A** determined that the accessing node is included in the local management domain, it requests the TSP in the accessing node (not shown in the figure) to track the path through which the requested user accessed the network (in the step **406**).

Thereafter, this operation is repeated until the TRP **63A** determines that the requested user is a local user.

When the TRP **63A** determined that the accessing node is in another management domain in the step **405**, it requests the TSP **64C** in the accessing node **22** to track the path through which the requested user accessed the network (in the step **411**).

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When the TSP 64C received the tracking request, it substitutionally starts tracking the path through which the requested user accessed the network in the management domain included in the local node 22 instead of the node 16 which requested the tracking operation (in the step 412).

Likewise, the processes from the step 401 to the step 412 are repeated.

When the TRP 63A determined that the requested user is a local user in the step 402, the TSP 64C in the node 22 transfers all the collected information with respect to the network tracking path to the TRP 64A in the requesting node 16 (in the step 413) and then terminates the tracking operation (in the step 403).

As was described above, in the distributed type computer network according to the present invention, a path through which a requested user accessed the network can be determined rapidly and accurately without considering the overall structure thereof.

Moreover, in the distributed type computer network according to the present invention, even if the network access path entered a plurality of management domains, a path through which a requested user accessed the network can be rapidly and accurately determined.

What is claimed is:

1. A distributed computer network for tracking a path through which a user accessed a network, said distributed computer network having a plurality of domains, each of said domains having at least one node, each of said nodes comprising:

a node bus;

first determination means for determining if the node was accessed by a user locally or remotely, connected to the bus;

user information storage means, connected to the bus, for storing a name of a user accessing the node, whether the node was accessed by a local access or a remote access as determined by the first determination means, and an accessing node name when the first determination means determines that the node was accessed remotely;

process information storage means, connected to the bus, for storing an activated process name and a process activated time as information with respect to a process activated in said node;

second determination means, connected to the bus, for determining whether an access of said node by said user is a local access or a remote access by examining the stored information of the user information storage means;

check means, connected to the bus, for checking a name of an accessing node in accordance with the user name of said user by using said user information stored in said user information storage means when said second determination means determines that said node is remotely accessed;

tracking request means, connected to the bus, for transferring to said accessing node checked by said check means, tracking information including a local node name of the accessing node, a connection process activated time and an activated process name in accordance with the user name of said user stored in said user information storage means and said process information storage means and for requesting said accessing node to track a path through which said user accessed the network;

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information search means, connected to the bus, for searching process information for tracking information from another node requesting tracking; and

information transfer means, connected to the bus, for transferring user information in accordance with the process information searched by said information search means to said another node requesting tracking;

whereby said another node requesting tracking successively requests said accessing node to track said user through said tracking request means until said determination means determined that the access of the local node or said accessing node by said requested user is a local access.

2. A distributed computer network in which a plurality of nodes are included in a plurality of management domains, each of said nodes comprising:

a node bus;

first determination means, connected to the bus, for determining if the node was accessed by a user locally or remotely;

user information storage means, connected to the bus, for storing a user name, whether the node was accessed by a local access or a remote access as determined by the access determining means, and an accessing node name when the first determination means determines that the node was accessed remotely;

process information storage means, connected to the bus, for storing an activated process name and a process activated time as information with respect to a process activated in said node;

node name storage means, connected to the bus, for storing node names in a management domain of said node;

second determination means, connected to the bus, for determining whether an access of said node by a user is a local access or a remote access using said stored information indicating whether the node was accessed by a local access or a remote access stored in said user information storage means;

check means, connected to the bus, for checking a name of an accessing node in accordance with the user name of said user by using said user information stored in said information storage means when said second determination means determines that said node is remotely accessed;

third determination means, connected to the bus, for determining whether or not a name of said accessing node determined by said second determination means is stored in said node name storage means;

tracking request means, connected to the bus, for transferring to said accessing node a local node name of the accessing node, a connection process activated time and an activated process name in accordance with a user name of said requested user stored in said user information storage means and said process information storage means and for requesting said accessed node to track a path through which said user accessed the network when said third determination means determines that said accessing node name is stored in said node name storage means;

information search means, connected to the bus, for searching process information for tracking information from another node requesting tracking;

first information transfer means, connected to the bus, for transferring user information in accordance

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with the process information searched by said information search means to said anther node requesting tracking;

tracking substitute request means, connected to the bus, for requesting said accessed node to substitutionally track a path through which said user accessed the network when said third determination means determines that said accessed node name is not stored in said node name storage means; and

second information transfer means, connected to the bus, for transferring a network access path tracked by said requested node to said another node requesting tracking.

3. A distributed computer network as set forth in claim 1 or claim 2, each of said nodes further comprising:

timer means, connected to the bus, for retrieving a current time;

time transfer means, connected to the bus, for transferring said current time retrieved by said timer means to said accessing node when said tracking

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request means requests said accessed node to track the path through which said user accessed the network;

time error computation means, connected to the bus, for computing an error between the current time transferred from another node through said time transfer means and that of said timer means of the local node; and

time correction means, connected to the bus, for correcting a correction process activated time transferred from said another node through said tracking request means in accordance with said error computed by said error computation means.

4. A distributed type computer network as set forth in claim 1 or claim 2, whereby said user information storage means and said process information storage means further store a node access terminal name and a process activated terminal name so as to relate the user information with the process information.

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